$$quench = \left(\frac{\dfrac{x_{NOwet}}{1 - x_{H2Omeas}}}{x_{NOdry}} - 1 \right) \cdot \frac{x_{H2Oexp}}{x_{H2Omeas}} + \frac{x_{NO,CO2} - x_{NO,N2}}{x_{NO,N2}} \cdot \frac{x_{CO2exp}}{x_{CO2meas}} \qquad \text{Eq. 1065.675-1}$$

Where:

$quench$ = amount of CLD quench.

x_{NOdry} = measured concentration of NO upstream of a bubbler, according to §1065.370.

x_{NOwet} = measured concentration of NO downstream of a bubbler, according to §1065.370.

x_{H2Oexp} = expected maximum amount of water entering the CLD sample port during emission testing.

$x_{H2Omeas}$ = measured amount of water entering the CLD sample port during the quench verification specified in §1065.370.

$x_{NO,CO2}$ = measured concentration of NO when NO span gas is blended with CO_2 span gas, according to §1065.370.

$x_{NO,N2}$ = measured concentration of NO when NO span gas is blended with N_2 span gas, according to §1065.370.

x_{CO2exp} = expected maximum amount of CO_2 entering the CLD sample port during emission testing.

$x_{CO2meas}$ = measured amount of CO_2 entering the CLD sample port during the quench verification specified in §1065.370.

Example:

x_{NOdry} = 1800.0 µmol/mol
x_{NOwet} = 1760.5 µmol/mol
x_{H2Oexp} = 0.030 mol/mol
$x_{H2Omeas}$ = 0.017 mol/mol
$x_{NO,CO2}$ = 1480.2 µmol/mol
$x_{NO,N2}$ = 1500.8 µmol/mol
x_{CO2exp} = 2.00%
$x_{CO2meas}$ = 3.00%

$$quench = \left(\frac{\dfrac{1760.5}{1 - 0.017}}{1800.0} - 1 \right) \cdot \frac{0.030}{0.017} + \frac{1480.2 - 1500.8}{1500.8} \cdot \frac{2.00}{3.00}$$

$quench = -0.00888 - 0.00915 = -1.80\%$

§ 1065.690 Buoyancy correction for PM sample media.

(a) *General.* Correct PM sample media for their buoyancy in air if you weigh them on a balance. The buoyancy correction depends on the sample media density, the density of air, and the density of the calibration weight used to calibrate the balance. The buoyancy correction does not account for the buoyancy of the PM itself, because the mass of PM typically accounts for only (0.01 to 0.10)% of the total weight. A correction to this small fraction of mass would be at the most 0.010%.

(b) *PM sample media density.* Different PM sample media have different densities. Use the known density of your sample media, or use one of the densities for some common sampling media, as follows:

(1) For PTFE-coated borosilicate glass, use a sample media density of 2300 kg/m³.

(2) For PTFE membrane (film) media with an integral support ring of polymethylpentene that accounts for 95% of the media mass, use a sample media density of 920 kg/m³.

(3) For PTFE membrane (film) media with an integral support ring of PTFE, use a sample media density of 2144 kg/m³.

(c) *Air density.* Because a PM balance environment must be tightly controlled to an ambient temperature of (22 ±1) °C and a dewpoint of (9.5 ±1) °C, air density is primarily function of atmospheric pressure. We therefore specify a buoyancy correction that is only a function of atmospheric pressure. Using good engineering judgment, you

may develop and use your own buoyancy correction that includes the effects of temperature and dewpoint on density in addition to the effect of atmospheric pressure.

(d) *Calibration weight density.* Use the stated density of the material of your metal calibration weight. The example calculation in this section uses a density of 8000 kg/m³, but you should know the density of your weight from the calibration weight supplier or the balance manufacturer if it is an internal weight.

(e) *Correction calculation.* Correct the PM sample media for buoyancy using the following equations:

$$m_{cor} = m_{uncor} \cdot \left(\frac{1 - \dfrac{\rho_{air}}{\rho_{weight}}}{1 - \dfrac{\rho_{air}}{\rho_{media}}} \right) \qquad \text{Eq. 1065.690-1}$$

Where:

m_{cor} = PM mass corrected for buoyancy.
m_{uncor} = PM mass uncorrected for buoyance.
ρ_{air} = density of air in balance environment.
ρ_{weight} = density of calibration weight used to span balance.
ρ_{media} = density of PM sample media, such as a filter.

$$\rho_{air} = \frac{\rho_{abs} \cdot M_{mix}}{R \cdot T_{amb}} \qquad \text{Eq. 1065.690-2}$$

Where:

ρ_{abs} = absolute pressure in balance environment.
M_{mix} = molar mass of air in balance environment.
R = molar gas constant.
T_{amb} = absolute ambient temperature of balance environment.

Example:

p_{abs} = 99.980 kPa
$T_{sat} = T_{dew}$ = 9.5 °C
Using Eq. 1065.645–2,
p_{H20} = 1.1866 kPa
Using Eq. 1065.645–3,
x_{H2O} = 0.011868 mol/mol
Using Eq. 1065.640–8,
M_{mix} = 28.83563 g/mol
R = 8.314472 J/(mol·K)

T_{amb} = 20 °C

$$\rho_{air} = \frac{99.980 \cdot 28.83563}{8.314472 \cdot 293.15}$$

ρ_{air} = 1.18282 kg/m³
m_{uncorr} = 100.0000 mg
ρ_{weight} = 8000 kg/m³
ρ_{media} = 920 kg/m³

$$m_{cor} = 100.0000 \cdot \left[\frac{1 - \dfrac{1.18282}{8000}}{1 - \dfrac{1.18282}{920}} \right]$$

m_{cor} = 100.1139 mg

EFFECTIVE DATE NOTE: At 73 FR 37339, June 30, 2008, §1065.690 was amended by revising paragraph (e), effective July 7, 2008. For the convenience of the user, the revised text is set forth as follows:

§ 1065.690 Buoyancy correction for PM sample media.

*   *   *   *   *

(e) *Correction calculation.* Correct the PM sample media for buoyancy using the following equations:

$$m_{cor} = m_{uncor} \cdot \left[\frac{1 - \dfrac{\rho_{air}}{\rho_{weight}}}{1 - \dfrac{\rho_{air}}{\rho_{media}}} \right] \qquad \text{Eq. 1065.690-1}$$